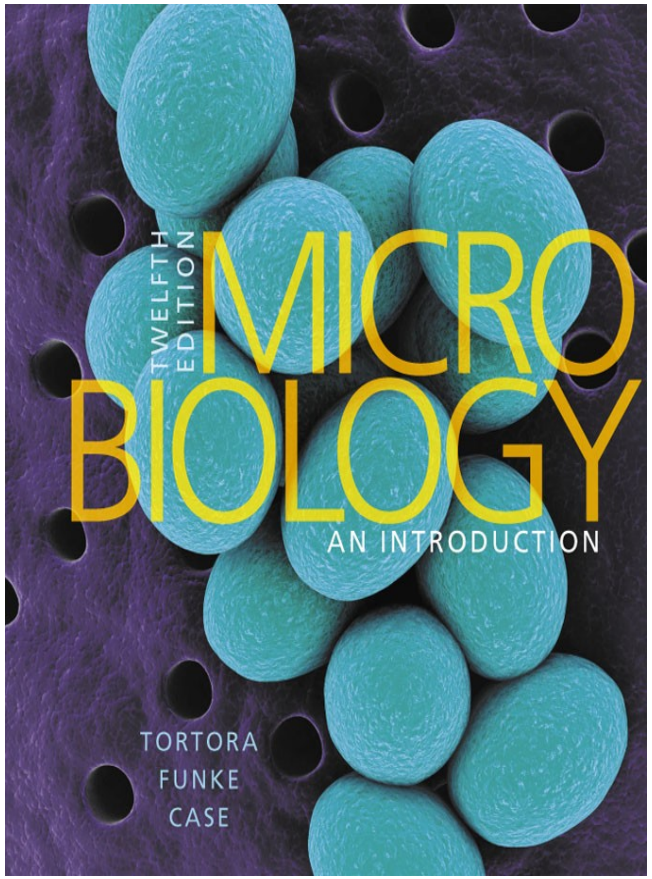
Microbiology an Introduction

Twelfth Edition

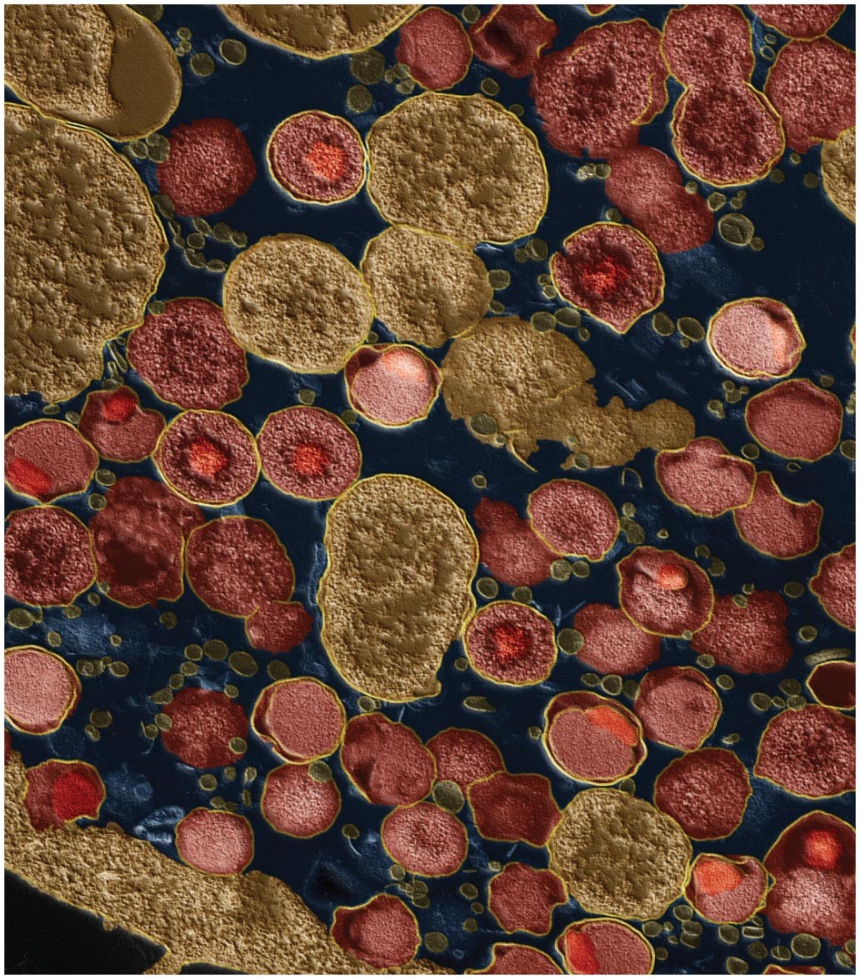


Chapter 24

Microbial Diseases of the Respiratory System

Pearson

Chlamydia Bacteria



Structure and Function of the Respiratory System (1 of 2)

Learning Objective

24-1 Describe how microorganisms are prevented from entering the respiratory system.

Structure and Function of the Respiratory System (2 of 2)

- **Upper respiratory system**
  - Nose, pharynx, middle ear, and eustachian tubes
  - Saliva and tears protect mucosal surfaces
- **Lower respiratory system**
  - Larynx, trachea, bronchial tubes, and alveoli
  - Ciliary escalator moves particles toward the throat via ciliary action
  - Alveolar macrophages destroy microorganisms in the lungs
  - Respiratory mucus protects mucosal surfaces

Figure 24.1 Structures of the Upper Respiratory System

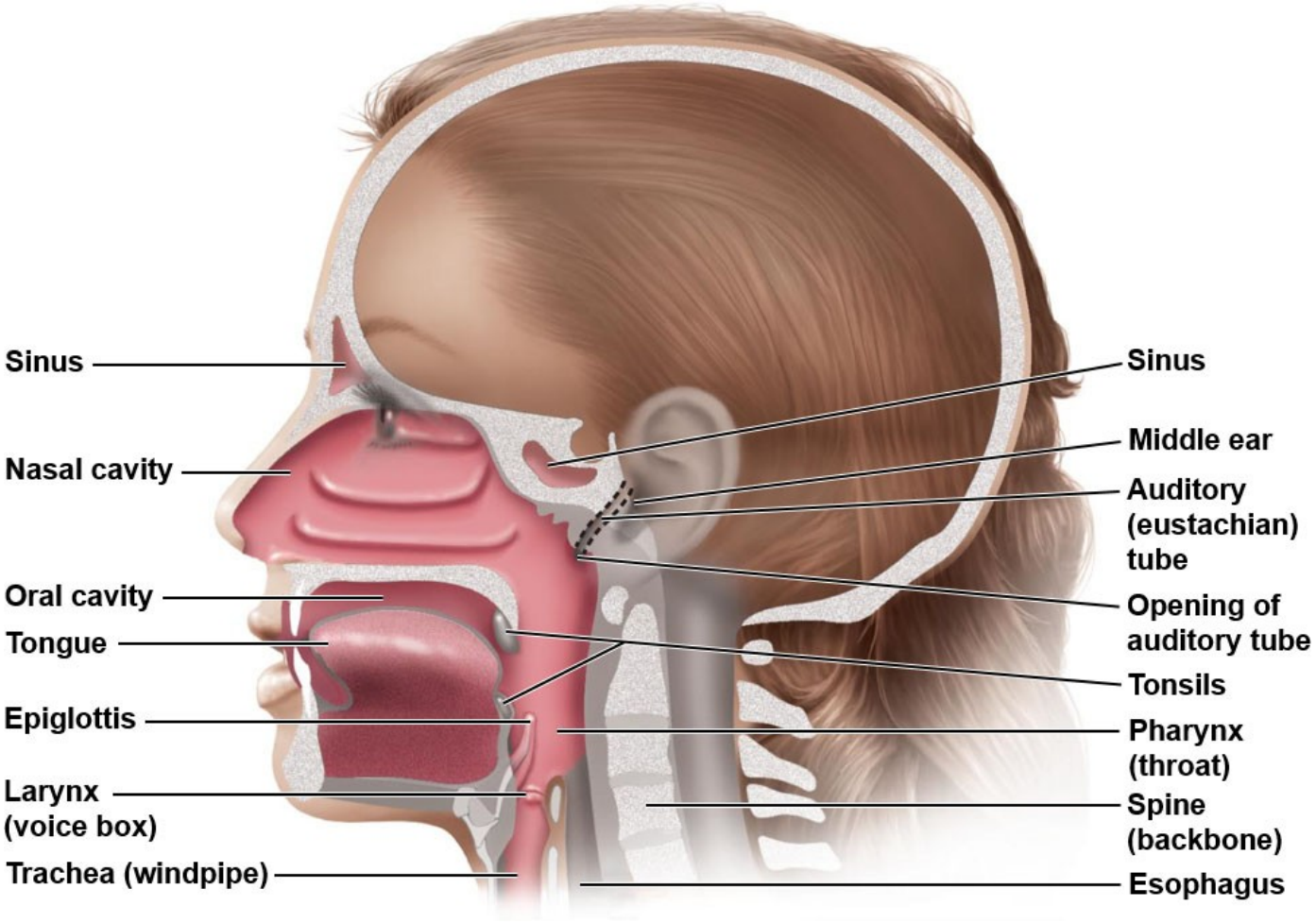


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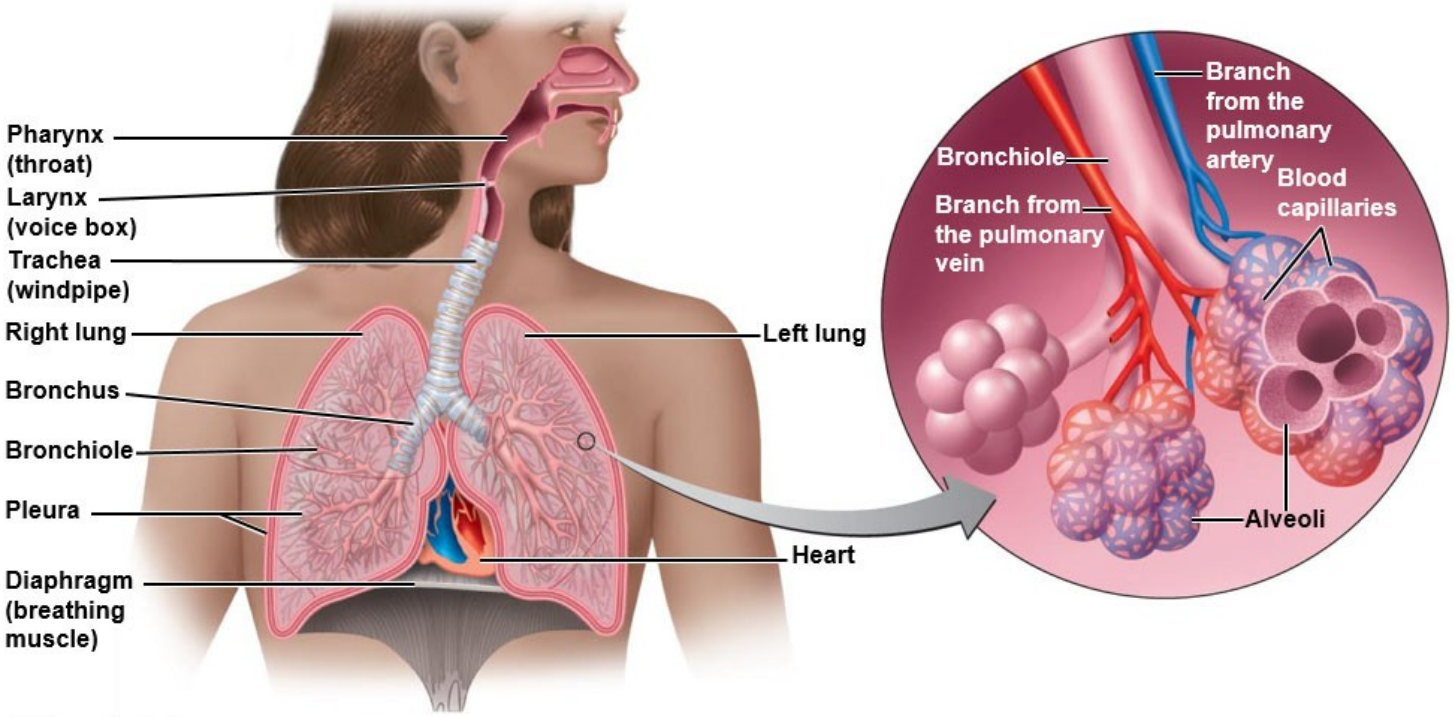
Figure 24.2 Structures of the Lower Respiratory System



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Check Your Understanding-1

Check Your Understanding

- What is the function of hairs in the nasal passages? 24-1

Normal Microbiota of the Respiratory System (1 of 2)

Learning Objective

24-2 Characterize the normal microbiota of the upper and lower respiratory systems.

Normal Microbiota of the Respiratory System (2 of 2)

- Normal microbiota suppress pathogens by competing for nutrients and producing inhibitory substances
- Lower respiratory system is nearly sterile

Check Your Understanding-2

Check Your Understanding

- Normally, the lower respiratory tract is nearly sterile. What is the primary mechanism responsible?

  24-2

Microbial Diseases of the Upper Respiratory System (1 of 2)

Learning Objective

24-3 Differentiate pharyngitis, laryngitis, tonsillitis, sinusitis, and epiglottitis.

Microbial Diseases of the Upper Respiratory System (2 of 2)

- **Pharyngitis**
  - Sore throat
- **Laryngitis**
- **Tonsillitis**
- **Sinusitis**
  - Usually self-limiting
- **Epiglottitis**
  - Most life-threatening disease of the upper respiratory system

Check Your Understanding-3

Check Your Understanding

- Which one of the following is most likely to be associated with a headache: pharyngitis, laryngitis, sinusitis, or epiglottitis?
  24-3

Bacterial Diseases of the Upper Respiratory System (1 of 2)

Learning Objective

24-4 List the causative agent, symptoms, prevention, preferred treatment, and laboratory identification tests for streptococcal pharyngitis, scarlet fever, diphtheria, cutaneous diphtheria, and otitis media.

Bacterial Diseases of the Upper Respiratory System (2 of 2)

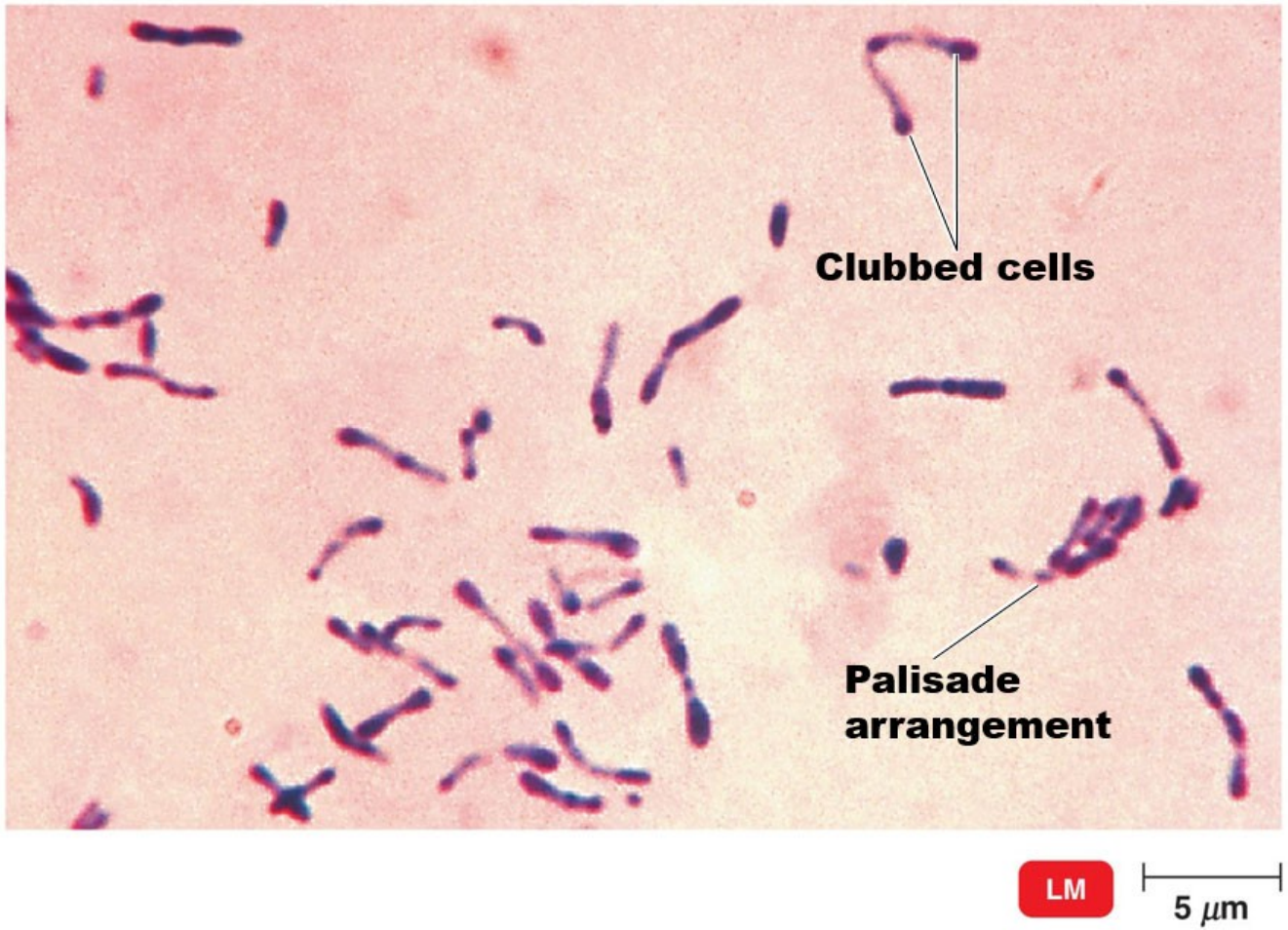
- **Streptococcal pharyngitis (strep throat)**
  - Caused by group A streptococci (GAS)
    - **Streptococcus pyogenes**
      - Resistant to phagocytosis
      - Streptokinases lyse clots
      - Streptolysins are cytotoxic
  - Local inflammation, fever, tonsillitis, enlarged lymph nodes
  - Diagnosis by **enzyme immunoassay (EIA)** tests
- **Scarlet fever**
  - Erythrogenic toxin produced by lysogenized **S. pyogenes**

Figure 24.3 Streptococcal Pharyngitis

Diphtheria

- Caused by **Corynebacterium diphtheriae**
  - Gram-positive rod; pleomorphic
- Forms a tough grayish membrane in the throat
  - Fibrin and dead tissue
  - Blocks passage of air to the lungs
- Exotoxin produced by lysogenized bacteria
  - Circulates in the blood; damages the heart and kidneys
- **Cutaneous diphtheria**
  - Forms skin ulcer
- Prevented by **DTaP vaccine**
  - Diphtheria toxoid

Figure 24.4 Corynebacterium Diphtheriae, the Cause of Diphtheria



Check Your Understanding-4

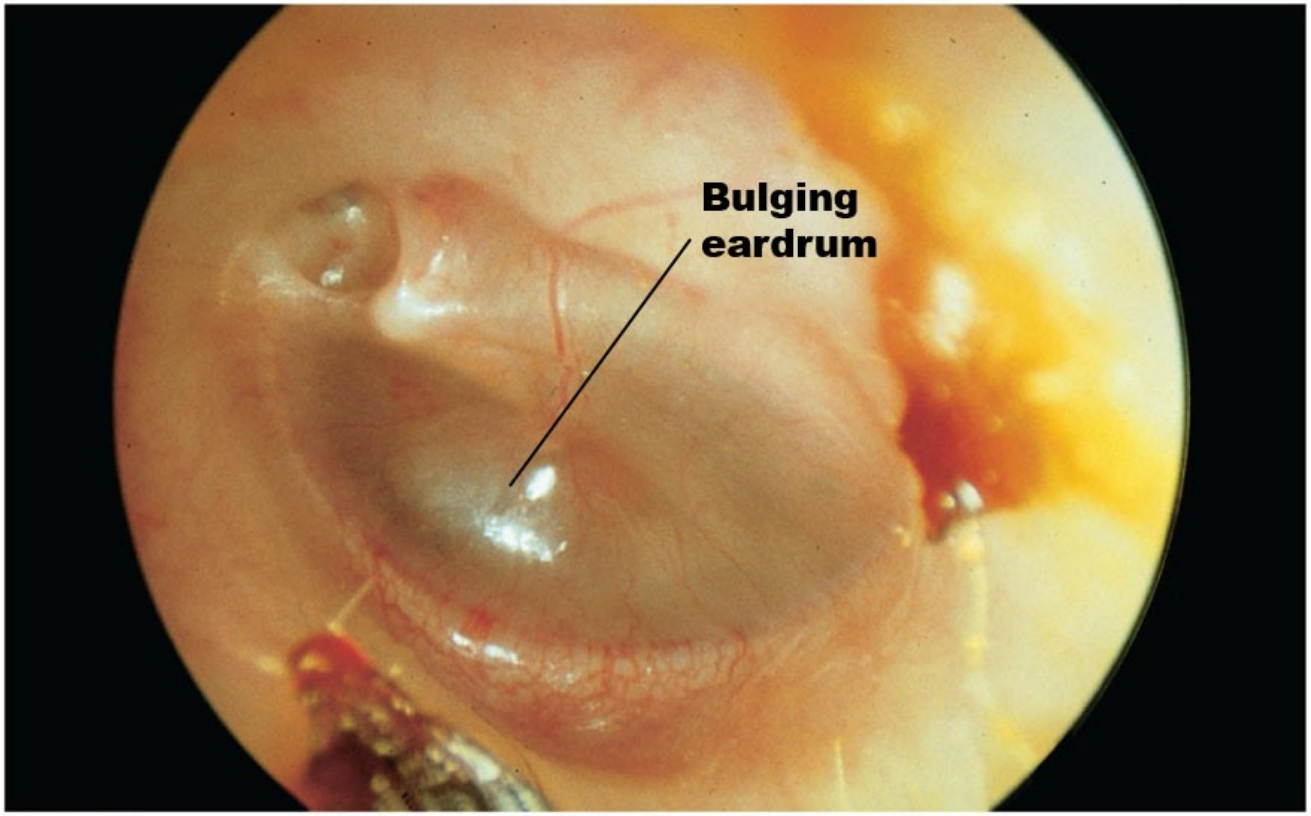
Check Your Understanding

- ✓ Among streptococcal pharyngitis, scarlet fever, or diphtheria, which two diseases are usually caused by the same genus of bacteria? 24-4

Otitis Media

- Infection of the middle ear
  - Formation of pus puts pressure on the eardrum
- Causes
  - **Streptococcus pneumoniae** (35%)
  - **Nonencapsulated Haemophilus influenzae** (20–30%)
  - **Moraxella catarrhalis** (10–15%)
  - **S. pyogenes** (8–10%)
  - **Staphylococcus aureus** (1–2%)
- Common in childhood due to smaller auditory tube
- Treated with broad-spectrum penicillins

Figure 24.5 Acute Otitis Media, with Bulging Eardrum



Viral Disease of the Upper Respiratory System

Learning Objective

24-5 List the causative agents and treatments for the common cold.

The Common Cold

- Over 200 different viruses
  - Rhinoviruses (30–50%)
    - Thrive in temperatures lower than body temperature
  - Coronaviruses (10–15%)
- Sneezing, nasal secretion, congestion
  - Can lead to laryngitis and otitis media
  - Not accompanied by fever
- Antibiotics are of no use
  - Relief via cough suppressants and antihistamines

Check Your Understanding-5

Check Your Understanding

- Which viruses, rhinoviruses, or coronaviruses, cause about half of the cases of the common cold? 24-5

Diseases in Focus: Microbial Diseases of the Upper Respiratory System

- A patient presents with fever and a red, sore throat. Later, a grayish membrane appears in the throat. Gram-positive rods are cultured from the membrane.
- Can you identify infections that could cause these symptoms?

Diseases in Focus 24.1 (1 of 2)

Diseases in Focus 24.1 (2 of 2)

Disease	Pathogen	Symptoms	Treatment
Bacterial Diseases			
Epiglottitis	**Haemophilus influenzae**	Inflammation of the epiglottis	Antibiotics; maintain airway Prevention: Hib vaccine
Streptococcal Pharyngitis (strep throat)	Streptococci, especially **Streptococcus pyogenes**	Inflamed mucous membranes of the throat	Penicillin
Scarlet Fever	Erythrogenic toxin-producing strains of **Streptococcus pyogenes**	Streptococcal exotoxin causes reddening of skin and tongue and peeling of affected skin	Penicillin
Diphtheria	**Corynebacterium diphtheriae**	Grayish membrane forms in throat; cutaneous form also occurs	Penicillin and antitoxin Prevention: DTaP vaccine
Otitis Media	Several agents, especially **Staphylococcus aureus, Streptococcus pneumoniae**, and **Haemophilus influenzae**	Accumulations of pus in middle ear cause painful pressure on eardrum	Broad-spectum antibiotics Prevention: pneumococcal vaccine
Viral Disease			
Common Cold	Rhinoviruses, coronaviruses	Familiar symptoms of coughing, sneezing, runny nose	Supportive

Microbial Diseases of the Lower Respiratory System

- Caused by many of the same bacteria and viruses as the upper respiratory system
  - **Bronchitis**
  - **Bronchiolitis**
  - **Pneumonia**
    - Pulmonary alveoli are involved

Bacterial Diseases of the Lower Respiratory System

Learning Objectives

24-6 List the causative agent, symptoms, prevention, preferred treatment, and laboratory identification tests for pertussis and tuberculosis.

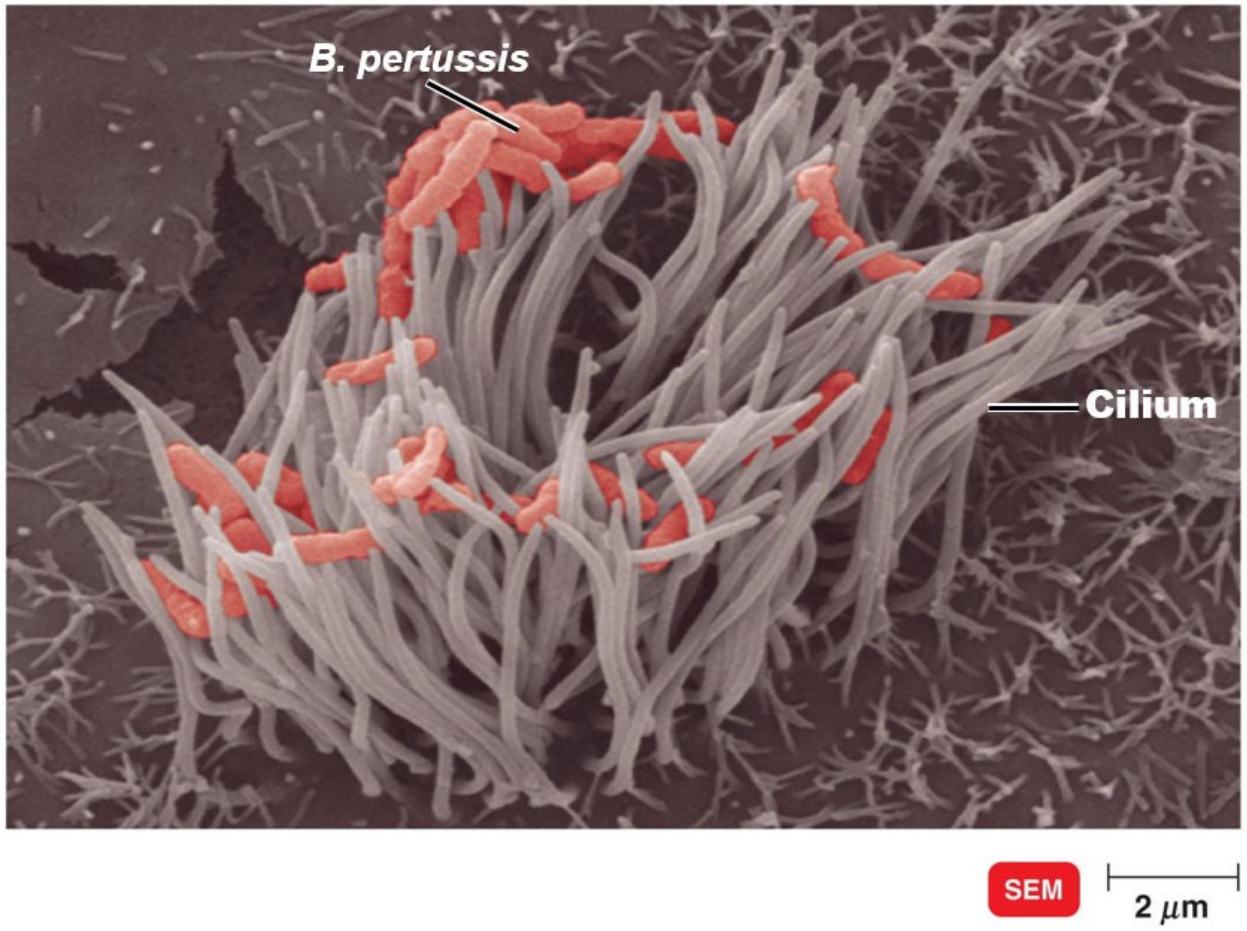
24-7 Compare and contrast the seven bacterial pneumonias discussed in this chapter.

24-8 List the etiology, method of transmission, and symptoms of melioidosis.

Pertussis (Whooping Cough) (1 of 2)

- Caused by **Bordetella pertussis**
  - Gram-negative coccobacillus
- Produces a capsule
  - Allows attachment to ciliated cells in the trachea
    - Destroys ciliated cells and shuts down the ciliary escalator
- Tracheal cytotoxin of cell wall damages ciliated cells
- Pertussis toxin enters the bloodstream

Figure 24.6 Ciliated Cells of the Respiratory System Infected with Bordetella Pertussis



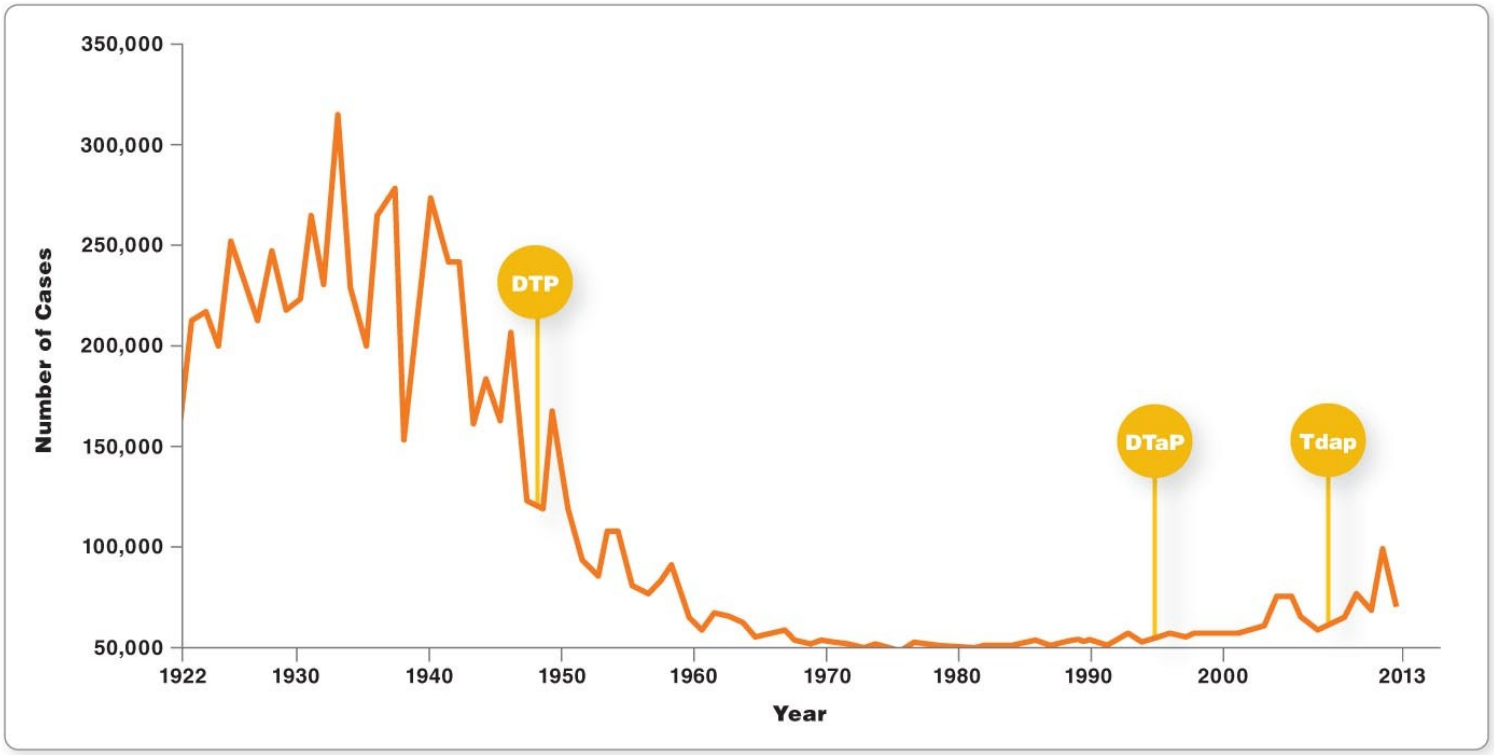
Pertussis (Whooping Cough) (2 of 2)

- Stage 1: catarrhal stage, like the common cold
- Stage 2: paroxysmal stage, violent coughing, gasping for air
- Stage 3: convalescence stage, may last for months
- Prevented by **DTaP** vaccine
- Treated with erythromycin or other macrolides

Big Picture: Pertussis (1 of 2)

- Before vaccines, 6000 people died annually in the United States from pertussis
- Today the acellular pertussis vaccine (DTaP) is given

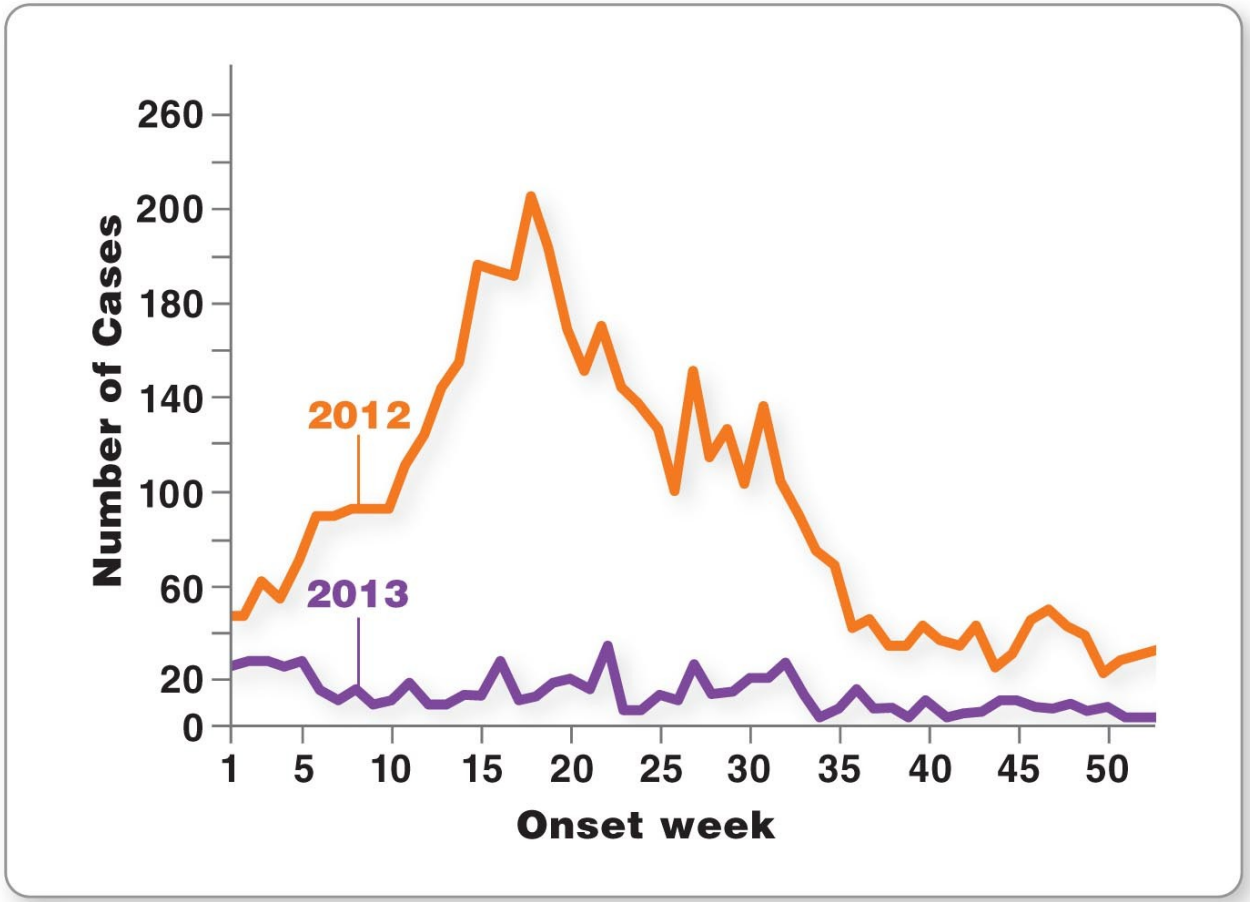
Big Picture pg. 682



Big Picture: Pertussis (2 of 2)

- Increasing pertussis cases due to:
  - Breakdown in herd immunity
  - Mutation of the organism
  - Better diagnostic test leading to more reporting
  - Acellular vaccine having lower long-term immunity
- New strategies for fighting pertussis
  - New booster for teens, adults, and pregnant women
  - Additional vaccination requirements for students
  - More government health campaigns

Big Picture pg. 683



Check Your Understanding-6

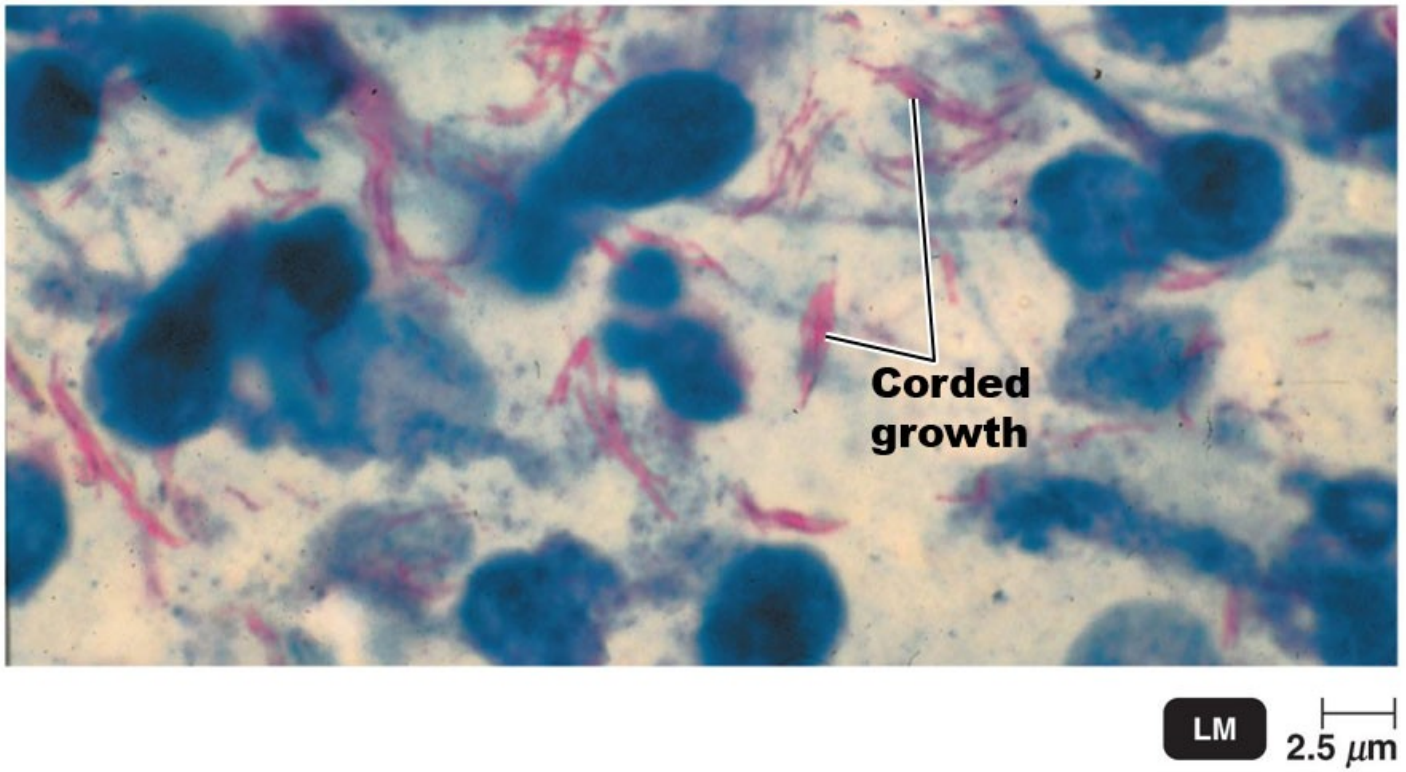
Check Your Understanding

- Another name for pertussis is whooping cough. This symptom is caused by the pathogens' attack on which cells?
  24-6

Tuberculosis (1 of 2)

- Caused by **Mycobacterium tuberculosis**
  - Acid-fast rod; obligate aerobe
  - 20-hour generation time
  - Lipids in the cell wall make it resistant to drying and antimicrobials
- Other causes
  - **Mycobacterium bovis**
    - **Bovine tuberculosis;** < 1% of U.S. cases
  - **Mycobacterium avium-intracellulare** complex
    - Infects people with late-stage HIV infection

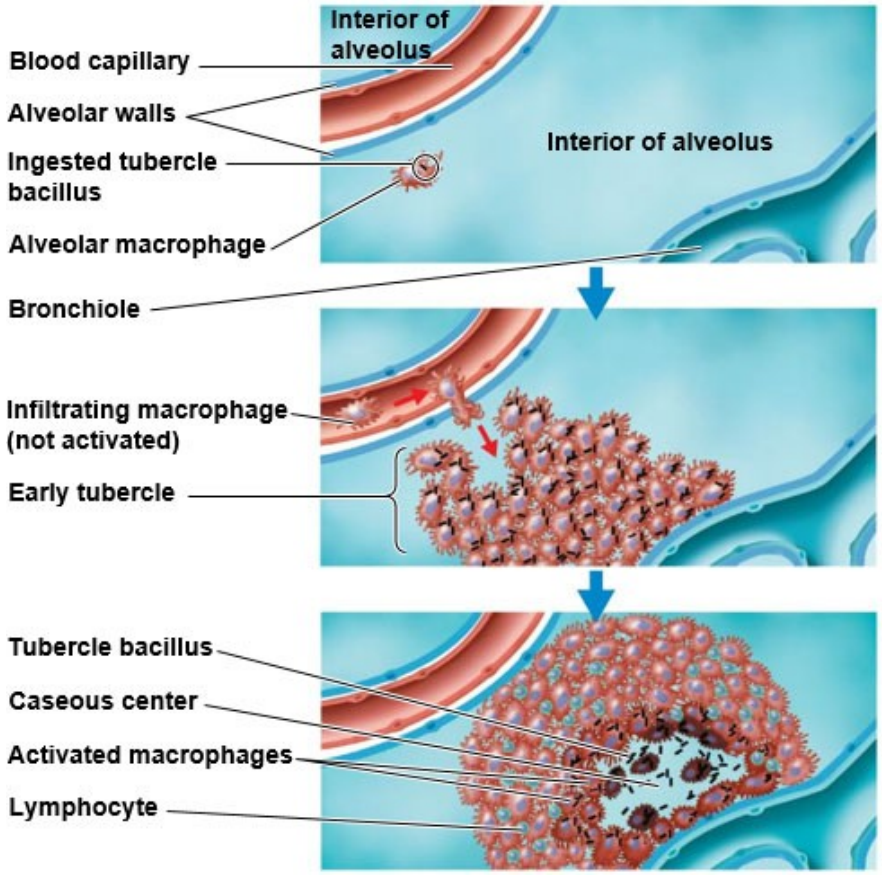
Figure 24.7 Mycobacterium Tuberculosis



Pathogenesis of Tuberculosis

- Inhaled organisms are phagocytized by alveolar macrophages
- Mycolic acids in the cell wall stimulate an inflammatory response
- Organisms are isolated in the walled-off tubercle
- Tubercles heal and become calcified (Ghon's complexes)
- Tubercle breaks down, releasing bacteria into the lungs and cardiovascular and lymphatic systems
  - Miliary tuberculosis: disseminated infection

Figure 24.8 The Pathogenesis of Tuberculosis (1 of 2)

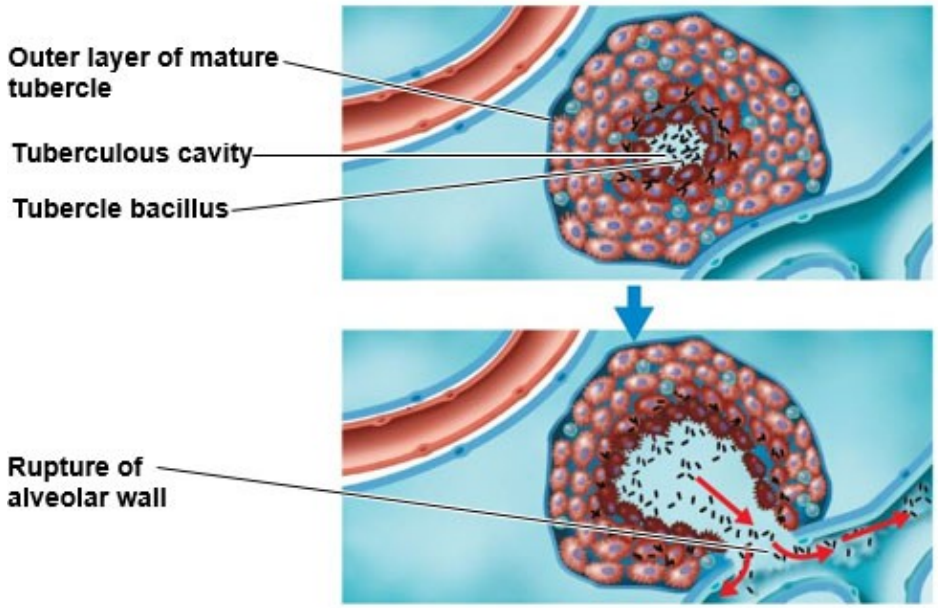


1. Tubercle bacilli that reach the alveoli of the lung are ingested by macrophages, but often some survive. Infection is present, but no symptoms of disease.

2. Tubercle bacilli multiplying in macrophages cause a chemotactic response that brings additional macrophages and other defensive cells to the area. These form a surrounding layer and, in turn, an early tubercle. Most of the surrounding macrophages are not successful in destroying bacteria but release enzymes and cytokines that cause a lung-damaging inflammation.

3. After a few weeks, disease symptoms appear as many of the macrophages die, releasing tubercle bacilli and forming a *caseous center* in the tubercle. The aerobic tubercle bacilli do not grow well in this location. However, many remain dormant (latent TB) and serve as a basis for later reactivation of the disease. The disease may be arrested at this stage, and the lesions become calcified.

Figure 24.8 The Pathogenesis of Tuberculosis (2 of 2)



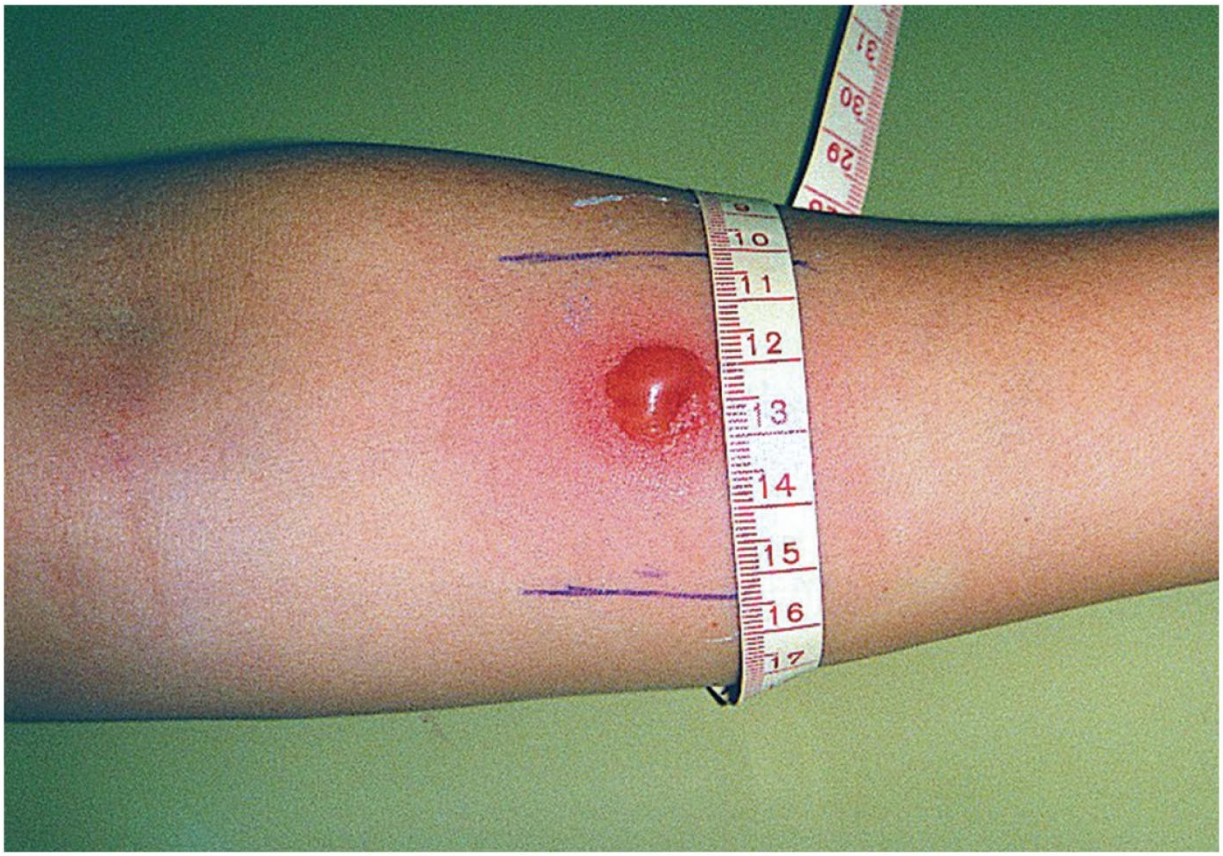
4 In some individuals, disease symptoms appear as a mature tubercle is formed. The disease progresses as the caseous center enlarges in the process called *liquefaction*. The caseous center now enlarges and forms an air-filled t*uberculous cavity* in which the aerobic bacilli multiply outside the macrophages.

5 Liquefaction continues until the tubercle ruptures, allowing bacilli to spill into a bronchiole and thus be disseminated throughout the lung and then to the circulatory and lymphatic systems.

Diagnosis of Tuberculosis

- **Tuberculin skin test**
  - Positive reaction means a current or previous infection
  - T cells react with purified protein derivative from the TB bacterium
    - Delayed hypersensitivity induration
- Followed by an X-ray or CT exam, acid-fast staining of sputum, and culturing of bacteria
- New rapid blood test for IFN-γ and PCR test
  - Higher specificity and less cross-reactivity

Figure 24.9 A Positive Tuberculin Skin Test on an Arm



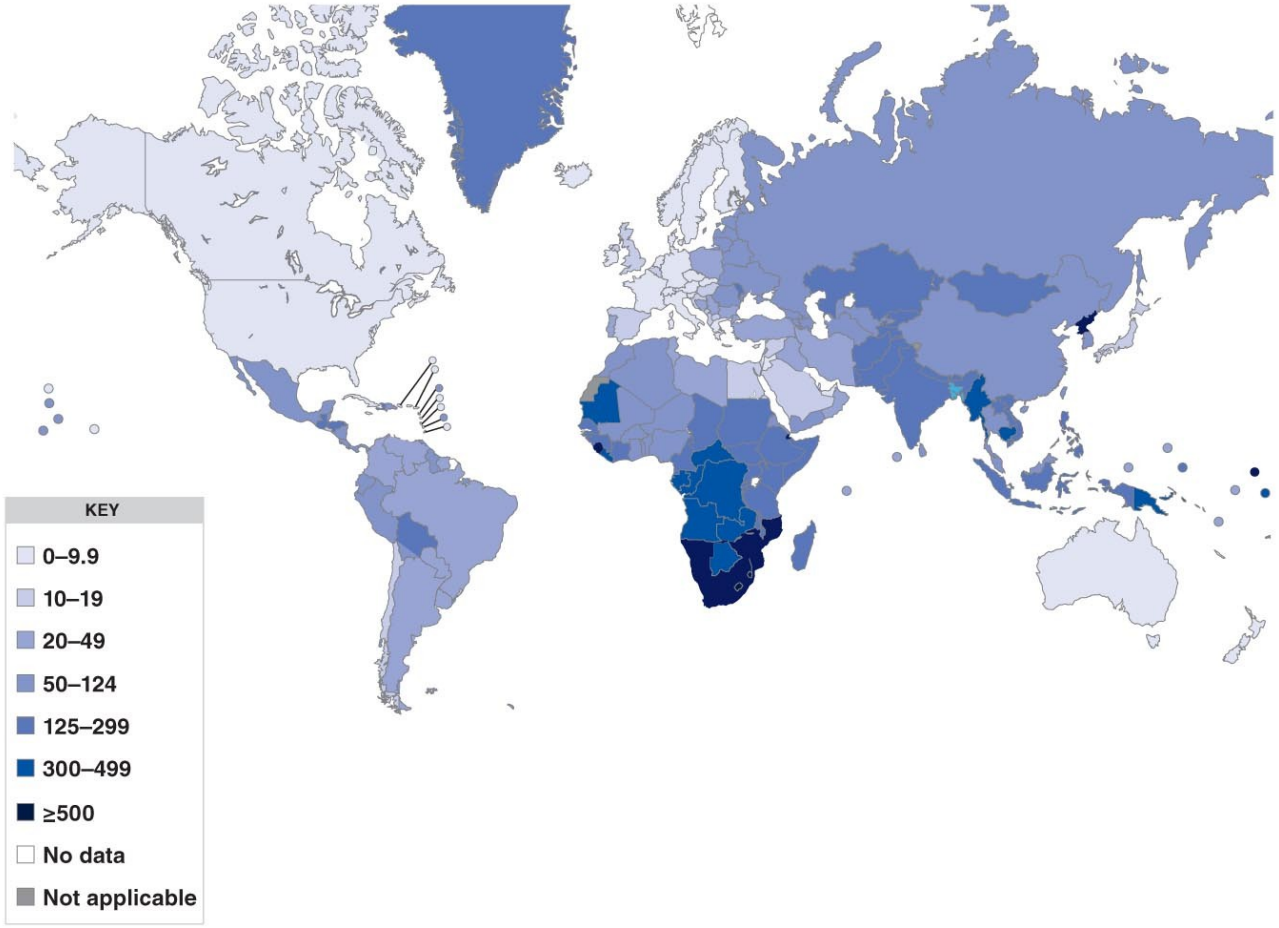
Treatment of Tuberculosis

- Minimum of 6 months of drug therapy due to slow growth and dormancy
- **First-line drugs:** isoniazid, ethambutol, pyrazinamide, rifampin
- **Second-line drugs:** aminoglycosides, fluoroquinolones, para-aminoslicyclic acid (PAS)
- **Multi-drug-resistant (MDR)** strains: resistant to first-line drugs
- **Extensively drug-resistant (XDR)** strains: resistant to second-line drugs

Tuberculosis (2 of 2)

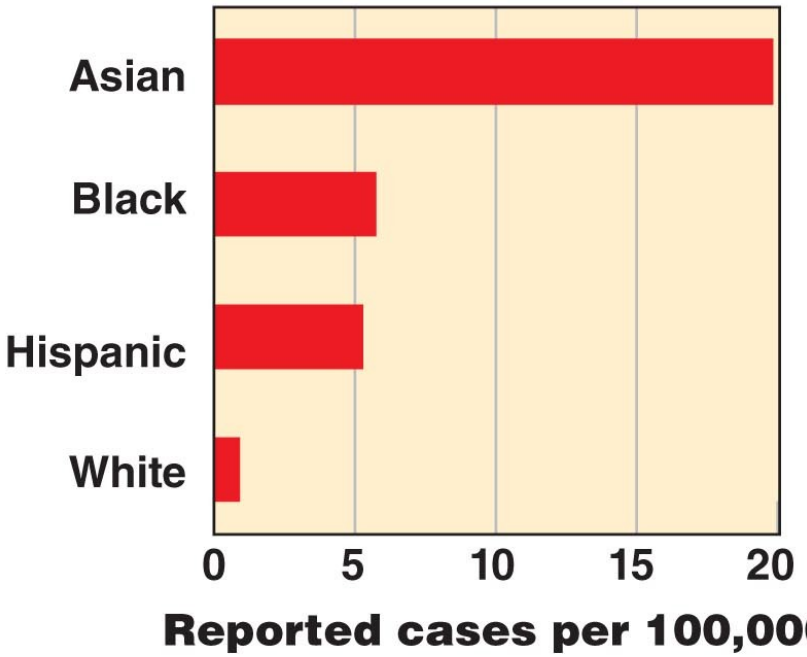
- 9 million develop TB annually; 2 million die
- ⅓ of the world's population infected
- Leading cause of death for those with HIV
- **BCG vaccine:** live culture of avirulent **M. bovis**
  - Not widely used in the United States due to questionable effectiveness

Figure 24.10a Distribution of Tuberculosis



(a) Estimated tuberculosis incidence worldwide, per 100,000 population

Figure 24.10b Distribution of Tuberculosis



(b) Reported tuberculosis cases per 100,000 population among American ethnic groups in 2012

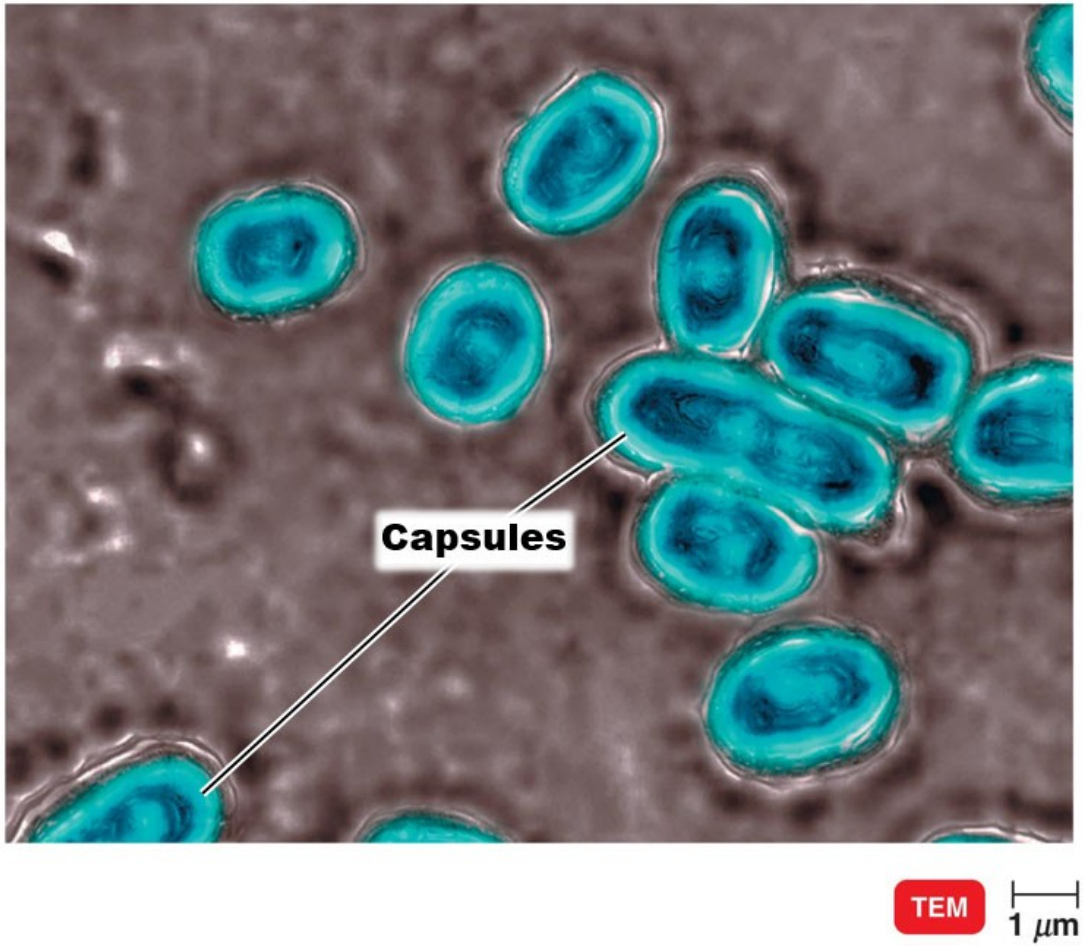
Bacterial Pneumonias

- Typical pneumonia
  - Caused by **S. pneumoniae**
- Atypical pneumonia
  - Caused by other microorganisms
- Lobar pneumonia
  - Infects the lobes of the lungs
- Bronchopneumonia
  - Infects the alveoli adjacent to the lungs
- Pleurisy
  - Pleural membranes inflamed

Pneumococcal Pneumonia

- Caused by **S. pneumoniae**
  - Gram-positive; encapsulated diplococci
  - 90 serotypes
- Infected alveoli of the lung fill with fluids and RBCs; interferes with oxygen uptake
- Diagnosis: optochin-inhibition test, bile solubility test, or antigen in urine
- Treated with macrolides and fluoroquinolones
- Prevented with conjugated pneumococcal vaccine

Figure 24.11 Streptococcus Pneumoniae, the Cause of Pneumococcal Pneumonia



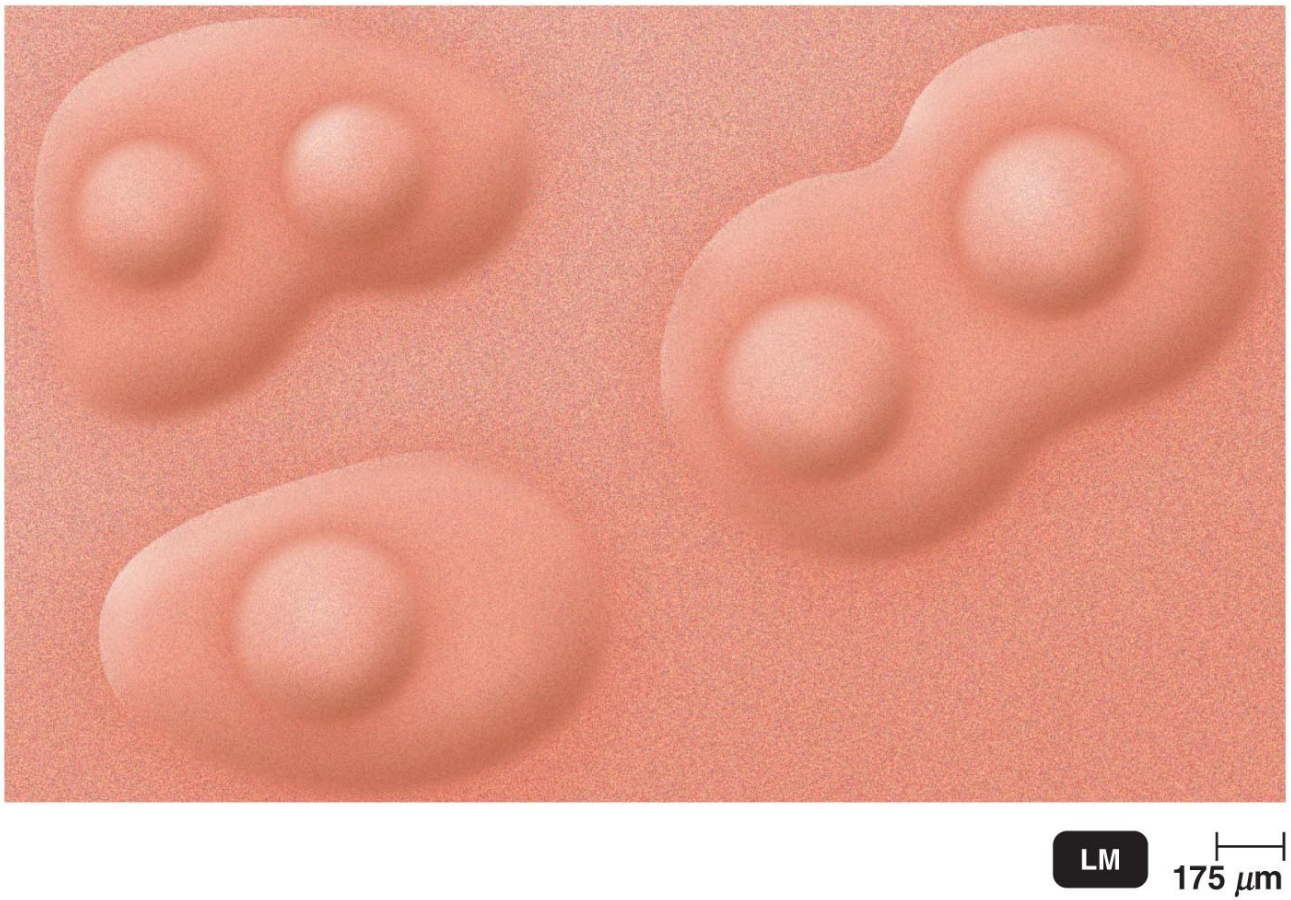
Haemophilus Influenzae Pneumonia

- Gram-negative coccobacillus
- Predisposing factors: alcoholism, poor nutrition, cancer, or diabetes
- Symptoms resemble those of pneumococcal pneumonia
- Diagnosis: isolation on special media for nutritional requirements (X and V factors)
- Treated with cephalosporins

Mycoplasmal Pneumonia

- Also called primary atypical pneumonia or walking pneumonia
- Caused by **Mycoplasma pneumoniae**
  - No cell wall
- Mild but persistent respiratory symptoms; low fever, cough, headache
  - Common in children and young adults
- "Fried-egg" appearance on media
- Diagnosis: PCR and serological testing
- Treated with tetracyclines

Figure 24.12 Colonies of Mycoplasma Pneumoniae, the Cause of Mycoplasmal Pneumonia



Legionellosis

- Also called **Legionnaires' disease**
- Caused by **Legionella pneumophila**
  - Aerobic, gram-negative rod
  - Grows in water and air conditioning, biofilms, and waterborne amebae
- Transmitted by inhaling aerosols; not transmitted person to person
- Symptoms: high fever and cough
  - Similar to symptoms of **Pontiac fever**
- Treated with erythromycin and macrolides

Psittacosis (Ornithosis)

- Caused by **Chlamydophila psittaci**
  - Gram-negative intracellular bacterium
- Transmitted to humans by **elementary bodies** from bird droppings transmitted through air
- Fever, headache, chills, disorientation
- Diagnosis: growth of bacteria in eggs or cell culture
- Treated with tetracyclines

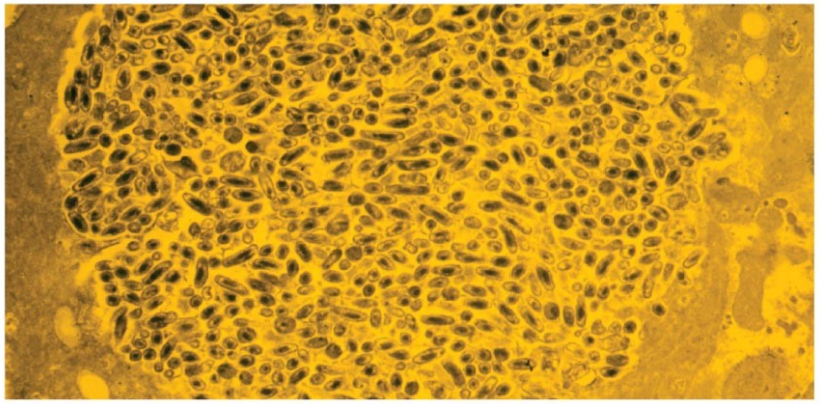
Chlamydial Pneumonia

- Caused by **Chlamydophila pneumoniae**
- Transmitted person to person
- Mild respiratory illness common in young people; resembles mycoplasmal pneumonia
- Possible association with artherosclerosis
- Diagnosis: serological tests
- Treated with tetracyclines

Q Fever

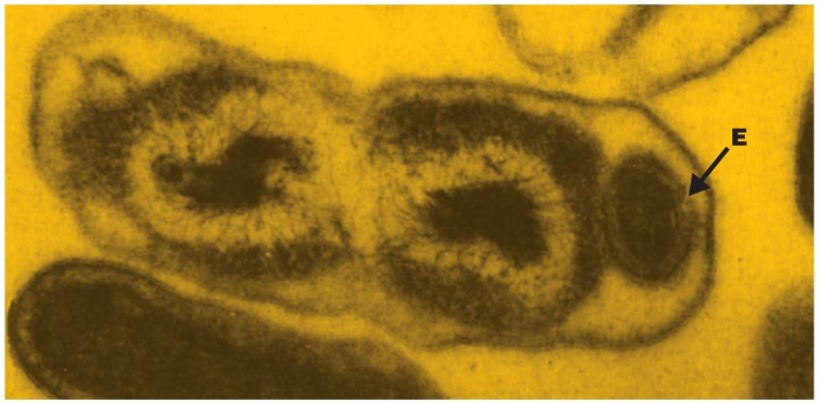
- Caused by **Coxiella burnetii**
  - Obligately parasitic, intracellular gamma proteobacteria
- Acute Q fever
  - High fever, muscle aches, headache, coughing
- Chronic Q fever
  - Endocarditis (may occur years after infection)
- Transmitted to farm animals from tick bites
  - Transmitted to humans from the inhalation of aerosols from animals and unpasteurized milk
- Treated with doxycycline; chloroquine for chronic infections

Figure 24.13 Coxiella Burnetii, the Cause of Q Fever



(a) Masses of *Coxiella burnetii* growing in a placental cell

TEM 2 μm



(b) This cell has just divided; notice the endospore-like body (E), which is probably responsible for the relative resistance of the organism.

TEM 0.5 μm

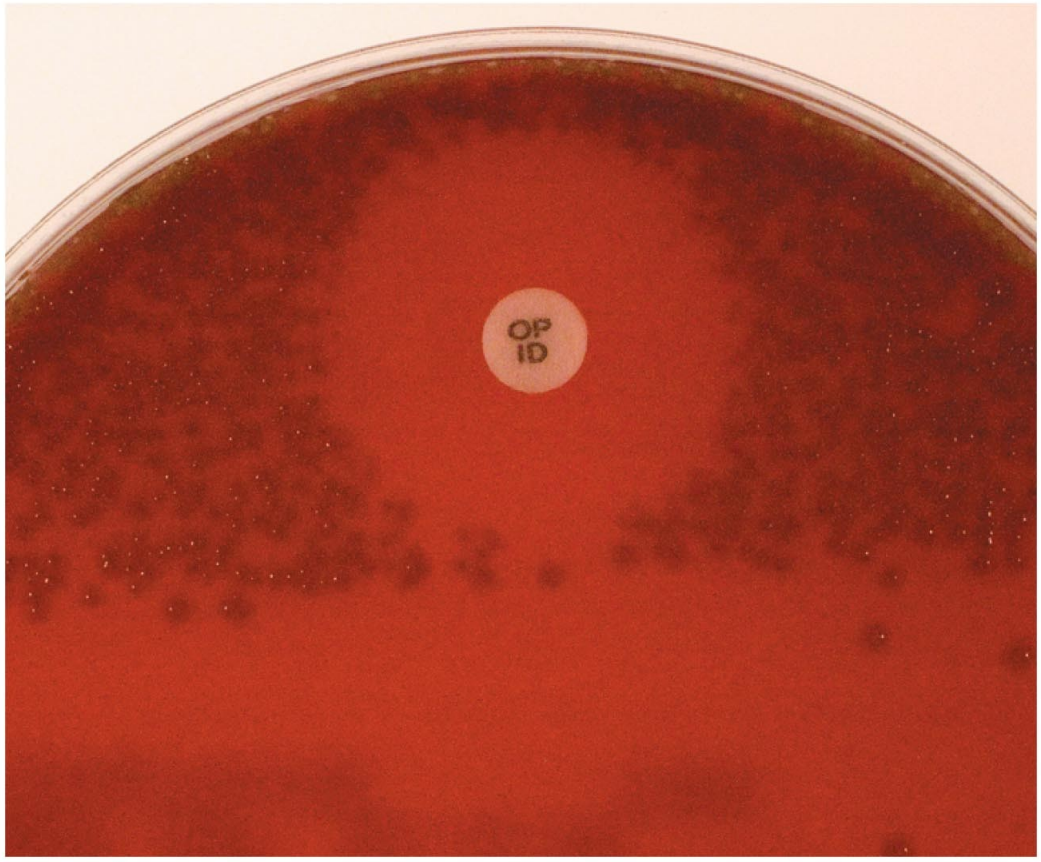
Melioidosis

- Caused by **Burkholderia pseudomallei**
  - Gram-negative rod
- Occurs mostly in southeast Asia and northern Australia (in moist soils)
- Commonly affects those with lowered immune systems
  - Pneumonia or tissue abscesses (necrotizing fasciitis) and severe sepsis
- Transmission by inhalation, puncture wounds, and ingestion
- Treated with ceftazidime

Diseases in Focus: Common Bacterial Pneumonias

- A 27-year-old man with a history of asthma is hospitalized with a 4-day history of progressive cough and 2 days of spiking fevers. Gram-positive cocci in pairs are cultured from a blood sample.
- Can you identify infections that could cause these symptoms?

Diseases in Focus 24.2 (1 of 3)



Diseases in Focus 24.2 (2 of 3)

Disease	Pathogen	Symptoms	Reservoir	Diagnosis	Treatment
Pneumococcal Pneumonia	**Streptococcus pneumoniae**	Infected alveoli of lung fill with fluids; interferes with oxygen uptake	Humans	Positive optochin inhibition test or bile solubility test; serological typing of bacteria	Fluoroquinolones Prevention: pneumococcal vaccine
Haemophilus influenzae Pneumonia	**Haemophilus influenzae**	Symptoms resemble pneumococcal pneumonia	Humans	Isolation; special media for nutritional requirements	Cephalosporins
Mycoplasmal Pneumonia	**Mycoplasma pneumoniae**	Mild but persistent respiratory symptoms; low fever, cough, headache	Humans	PCR and serological tests	Tetracyclines
Legionellosis	**Legionella pneumophila**	Potentially fatal pneumonia	Water	Culture on selective media; DNA probe	Erythromycin

Diseases in Focus 24.2 (3 of 3)

Disease	Pathogen	Symptoms	Reservoir	Diagnosis	Treatment
Psittacosis (Ornithosis)	**Chlamydophila psittaci**	Symptoms, if any, are fever, headache, chills	Birds	Growth of bacteria in eggs or cell culture	Tetracyclines
Chlamydial Pneumonia	**Chlamydophila pneumoniae**	Mild respiratory illness; resembles mycoplasmal pneumonia	Humans	Serological tests	Tetracyclines
Q Fever	**Coxiella burnetii**	Mild respiratory disease lasting 1–2 weeks; occasional complications such as endocarditis occur	Large mammals; can be transmitted via unpasteurized milk	Growth in cell culture	Doxycycline and chloroquine

Check Your Understanding-7

Check Your Understanding

- What group of bacterial pathogens causes what is informally called "walking pneumonia”?
  24-7
- The bacterium causing melioidosis in humans also causes a disease of horses known as what?
  24-8

Viral Diseases of the Lower Respiratory System

Learning Objective

24-9 List the causative agent, symptoms, prevention, and preferred treatment for viral pneumonia, RSV, and influenza.

Viral Pneumonia

- **Viral pneumonia** occurs as a complication of influenza, measles, or chickenpox
- Few labs are equipped to test clinical samples properly for viruses
- **SARS-associated coronavirus (SARS)**
  - Emerged in Asia in 2003
- **Middle East respiratory syndrome (MERS-CoV)**
  - Reported in Saudi Arabia in 2012

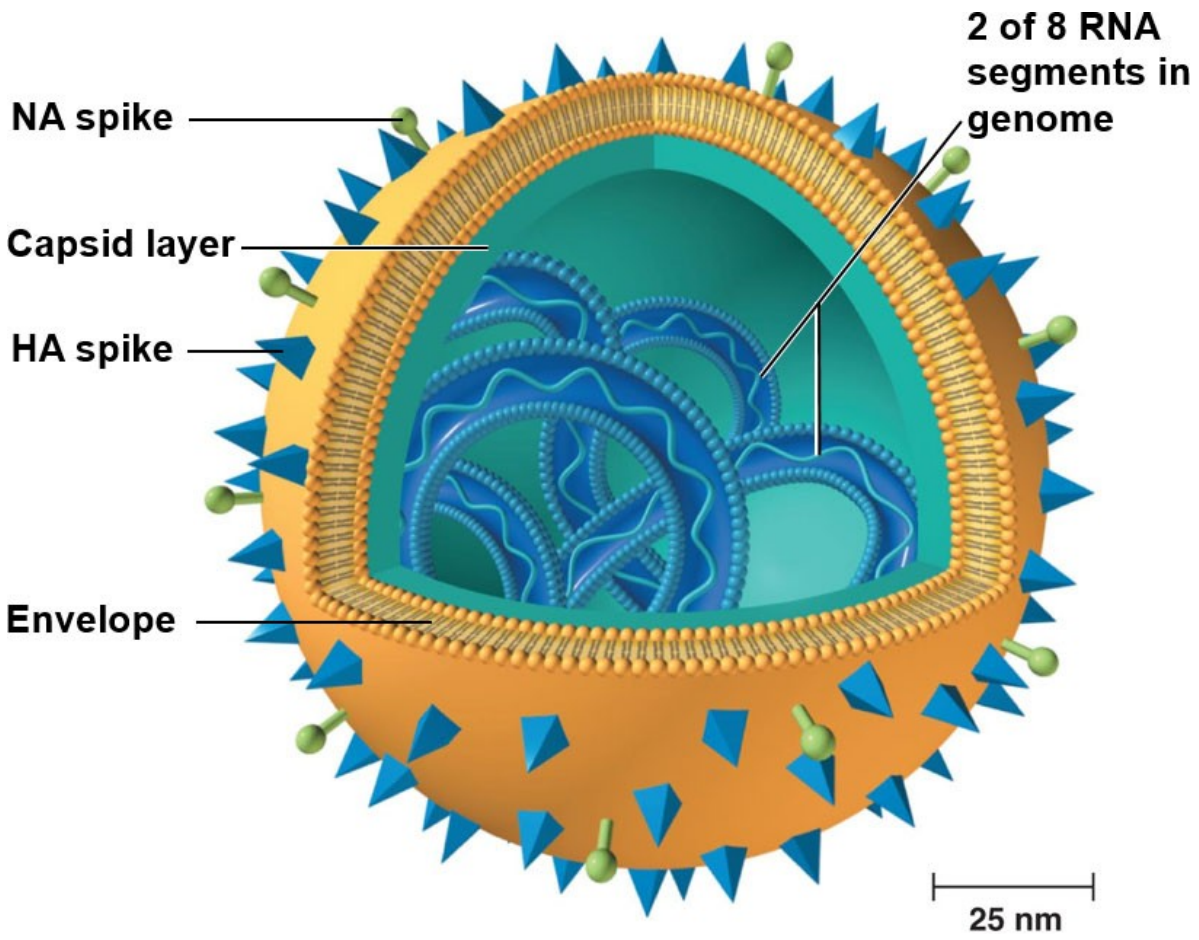
Respiratory Syncytial Virus (RSV)

- Most common viral respiratory disease in infants
  - Almost all children are infected by age 2
  - 4500 deaths annually
- Causes cell fusion (syncytium) in cell culture
- Coughing and wheezing for more than a week
- Diagnosis: serological test for viruses and antibodies
- Treated with ribavirin and palivizumab

Influenza (Flu) (1 of 3)

- **Influenzavirus**
  - Contains eight RNA segments and an outer lipid bilayer
- Chills, fever, headache, and muscle aches
  - No intestinal symptoms
  - 30,000 to 50,000 deaths in the United States annually
- Avian, swine, and mammalian strains
  - Swine serve as "mixing vessels" for new strains

Figure 24.14 Detailed Structure of the Influenza Virus



Influenza (Flu) (2 of 3)

- Hemagglutinin (HA) spikes
  - Recognize and attach to host cells
- Neuraminidase (NA) spikes
  - Help the virus separate from the infected cell
- **Antigenic drift**
  - Minor antigenic changes in HA and NA
  - Allow the virus to elude some host immunity
- **Antigenic shifts**
  - Changes great enough to evade most immunity
  - Lead to pandemics
  - Involve the reassortment of the eight RNA segments

Table 24.1 Human Influenza Viruses*

Table 24.1 Human Influenza Viruses*

Type	Antigenic Subtype	Year	Disease Severity
A	H3N2 (the first "modern" pandemic; originated in southern China)	1889	Moderate
	H1N1 (Spanish)	1918	Severe
	H2N2 (Asian)	1957	Severe
	H3N2 (Hong Kong)	1968	Moderate
	H1N1 (Russian)†	1977	Low
	H1N1 (Mexico)‡	2009	Low
B	None	1940	Moderate
C	None	1947	Very mild

*The conventional wisdom is that H1, H2, and H3 are human-infecting strains; H4, H5, H6, and H7 primarily infect animals, especially swine and poultry. (Avian influenza strains H5N1 and H7N7 have caused human fatalities.) †Probably escaped from a laboratory. At this time persons over age 20 were mostly immune from similar viruses circulating in the 1950s and earlier in the century. ‡The H1N1 virus causing this recent pandemic, the first in more than 40 years, differs significantly from the regular H1N1 virus that had been circulating. There has been confusion concerning a differentiating name for this virus. It has popularly been called the swine flu, and the CDC has referred to it as 2009H1N1, but in 2014 the WHO designed it as A(H1N1) pdm09. *Source:* Adapted from C. Mims, J. Playfair, I. Roitt, D. Wakelin, and R. Williams, **Medical Microbiology,** 2nd ed. London: Mosby International, 1998.

Influenza (Flu) (3 of 3)

- 1% mortality; usually the very young and very old
- Multivalent vaccine for the most important strains
  - Composition of the vaccine determined annually by the identification of circulating viruses
    - Labor-intensive to produce
    - Does not provide long-term immunity
- Difficult to diagnose from clinical symptoms
- Treated with zanamivir (Relenza) and oseltamivir (Tamiflu)

Check Your Understanding-8

Check Your Understanding

- Is reassortment of the RNA segments of the influenza virus the cause of antigenic shift or antigenic drift?
  24-9

Fungal Diseases of the Lower Respiratory System

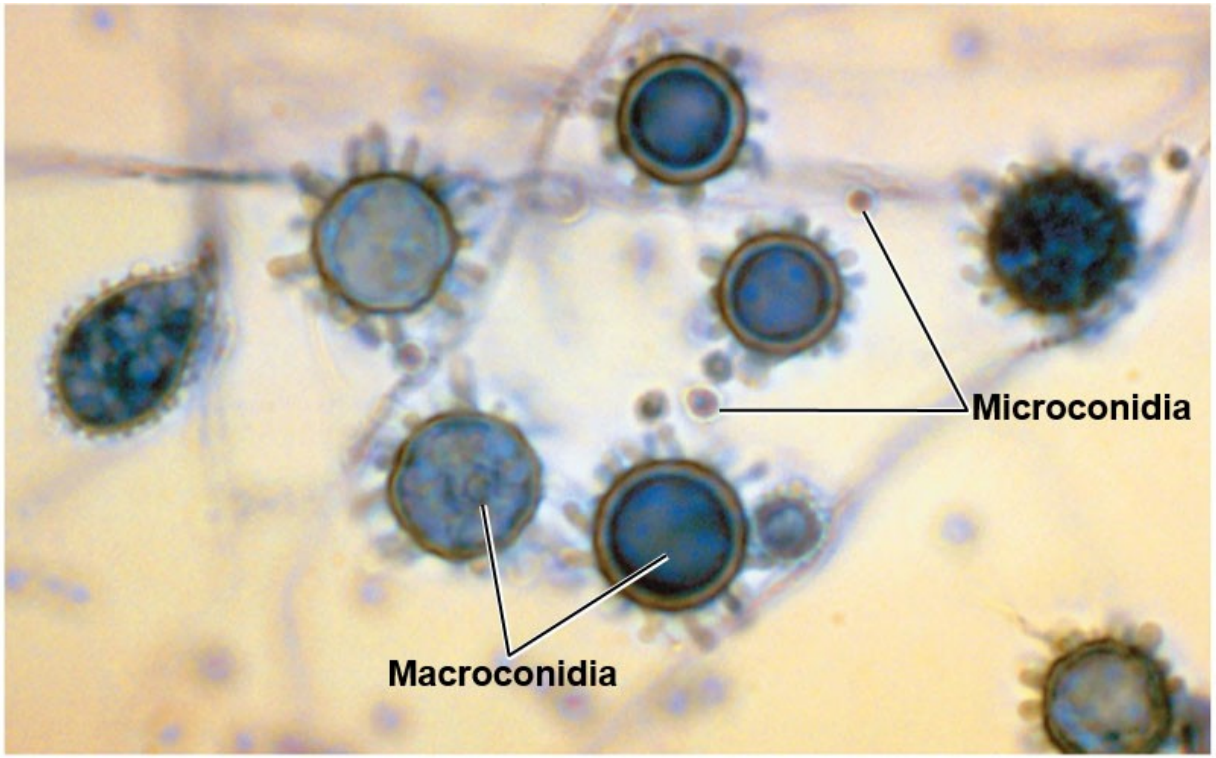
Learning Objective

24-10 List the causative agent, mode of transmission, preferred treatment, and laboratory identification tests for four fungal diseases of the respiratory system.

Histoplasmosis

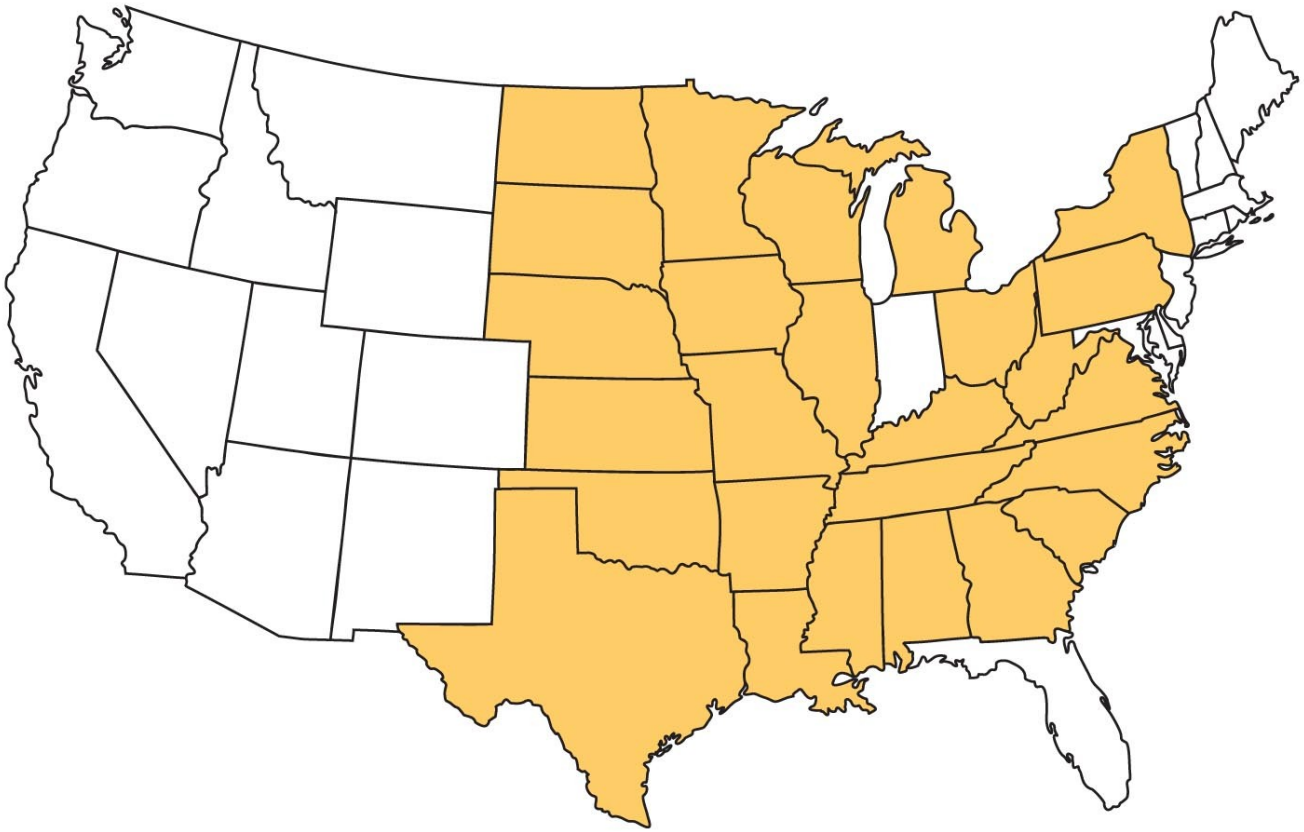
- Caused by **Histoplasma capsulatum**
  - Dimorphic fungus
  - Yeast-form grows intracellularly in macrophages
- Forms lung lesions; 0.1% of cases become a severe, generalized disease
- Acquired from airborne conidia in areas with bird or bat droppings
  - Limited geographical range in the United States
- Treated with amphotericin B or itraconazole

Figure 24.15 Histoplasma Capsulatum, a Dimorphic Fungus That Causes Histoplasmosis



The macroconidia of *Histoplasma capsulatum* are especially useful for diagnostic purposes. Microconidia bud off from hyphae and are the infectious form. At 37°C in tissues, the organism converts to a yeast phase composed of oval, budding yeasts.

Figure 24.16 Histoplasmosis Distribution



Coccidioidomycosis

- Also known as Valley fever or San Joaquin fever
- Caused by **Coccidioides immitis**
  - Dimorphic fungus
- Arthroconidia found in alkaline desert soils of the American Southwest
- Form a spherule filled with endospores in tissues
- Most infections are not apparent; fever, coughing, weight loss
  - < 1% of cases resemble tuberculosis
- Treated with amphotericin B or imidazole drugs

Figure 24.17 The Life Cycle of Coccidioides Immitis, the Cause of Coccidioidomycosis

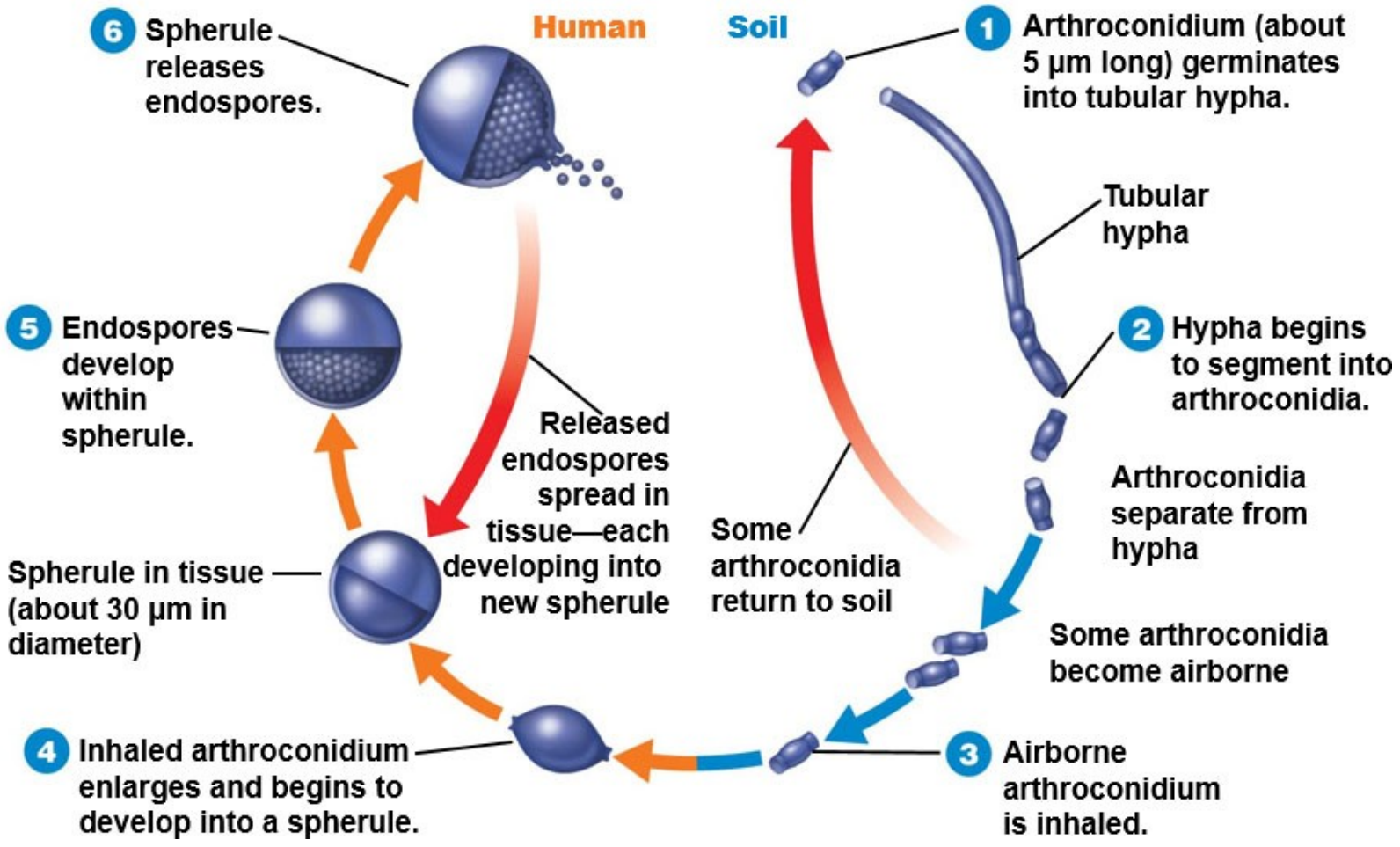
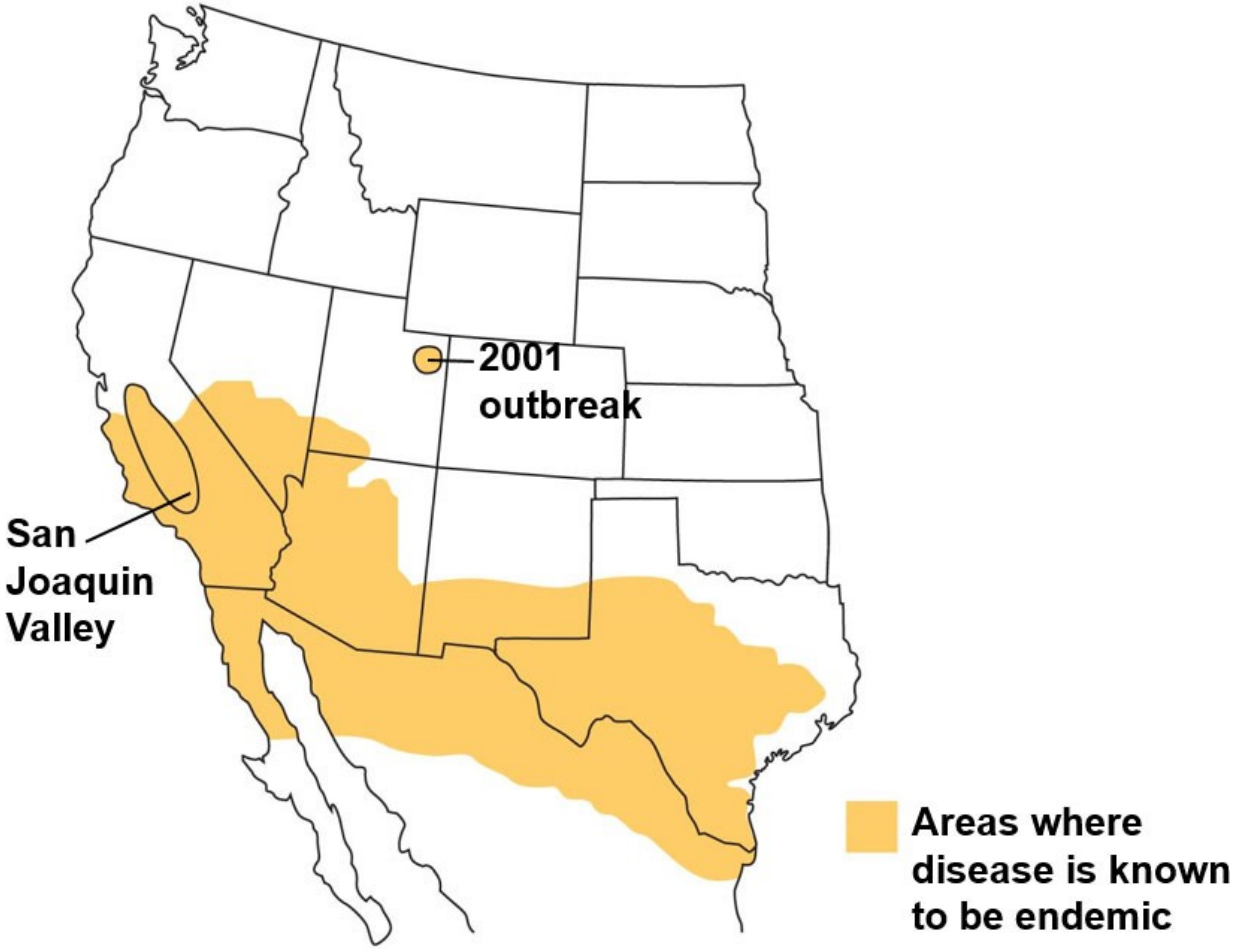


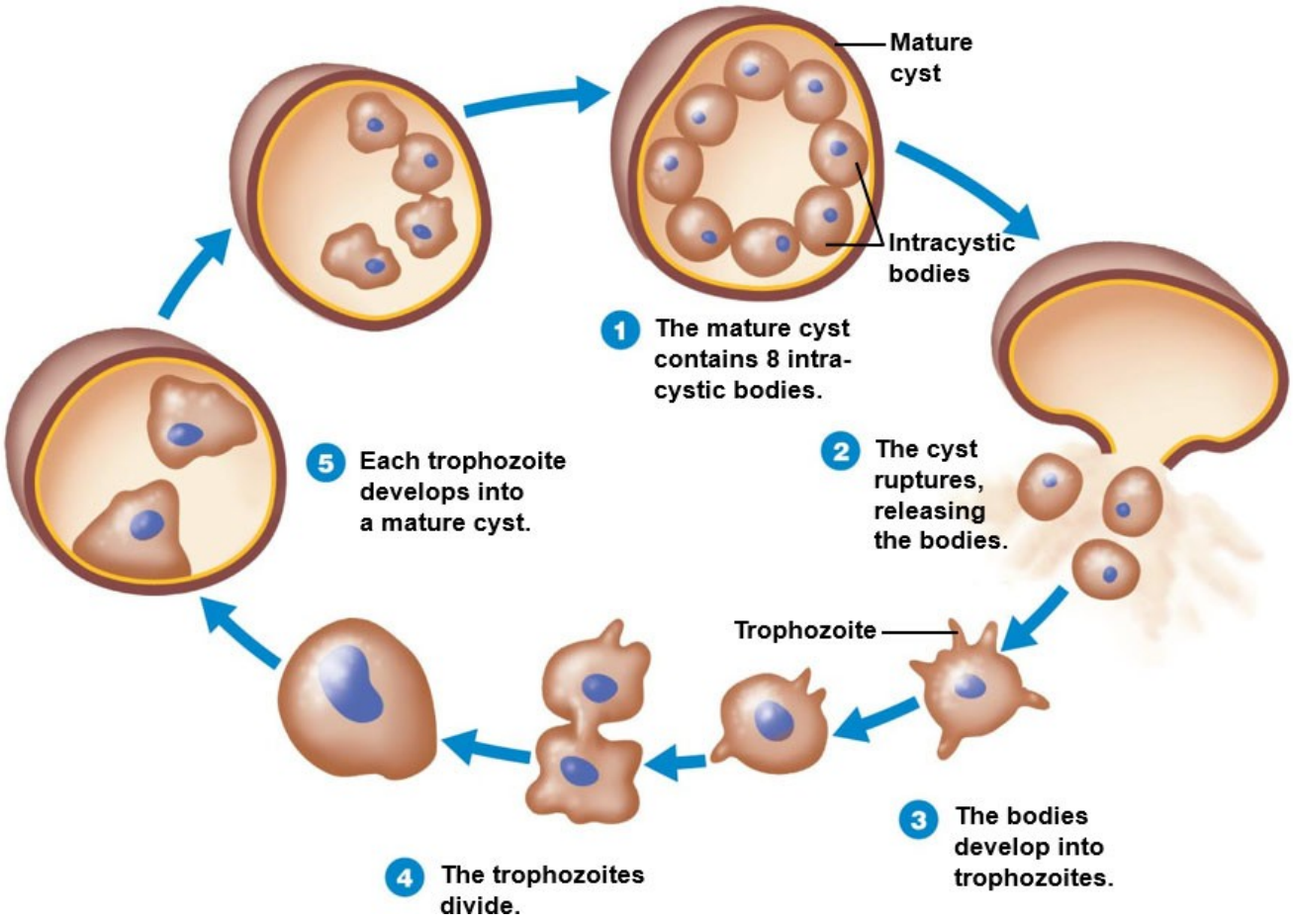
Figure 24.18 The U.S. Endemic Area for Coccidioidomycosis



Pneumocystis Pneumonia

- Caused by **Pneumocystis jirovecii**
  - No universal agreement if it is a protozoan or fungus
- Asymptomatic in the immunocompetent; causes pneumonia in the immunocompromised
  - Primary indicator of AIDS
- Found in the lining of the alveoli
  - Forms a cyst
  - Cysts rupture, releasing eight trophozoites
- Treated with trimethoprim-sulfamethoxazole

Figure 24.19 The Life Cycle of Pneumocystis Jirovecii, the Cause of Pneumocystis Pneumonia



Blastomycosis (North American Blastomycosis)

- Caused by **Blastomyces dermatitidis**
  - Dimorphic fungus
  - Grows in soil
- Symptoms resemble bacterial pneumonia; cutaneous abscesses; extensive tissue damage
- 30 to 60 deaths annually
- Treated with amphotericin B

Other Fungi Involved in Respiratory Disease

- **Aspergillus fumigatus**
  - Causes **aspergillosis**
  - Airborne conidia; grows in compost piles
- **Rhizopus** and **Mucor**
  - Mold spores
- Predisposing factors:
  - Immunocompromised state
  - Cancer
  - Diabetes

Check Your Understanding-9

Check Your Understanding

- The droppings of both blackbirds and bats support the growth of **Histoplasma capsulatum;** which of these two animal reservoirs is normally actually infected by the fungus?
  24-10

Diseases in Focus: Microbial Diseases of the Lower Respiratory System

- Three weeks after working on the demolition of an abandoned building in Kentucky, a worker is hospitalized for acute respiratory illness. At the time of demolition, a colony of bats inhabited the building. An X-ray examination reveals a lung mass. A purified protein derivative test is negative; a cytological examination of the mass reveals ovoid yeast cells.
- Can you identify infections that could cause these symptoms?

Diseases in Focus 24.3 (1 of 3)

Diseases in Focus 24.3 (2 of 3)

Disease	Pathogen	Symptoms	Reservoir	Diagnosis	Treatment
Bacterial Diseases					
Bacterial Pneumonia (see Diseases in Focus 24.2, page 691)					
Pertussis (whooping cough)	**Bordetella pertussis**	Spasms of intense coughing to clear mucus	Humans	Bacterial culture	Erythromycin Prevention: DTaP vaccine
Tuberculosis	**Mycobacterium tuberculosis** **M. bovis** **M. avium-intracellulare**	Cough, blood in mucus	Humans, cows: can Be transmitted via unpasteurized milk	X-ray imaging; presence of acid-fast bacilli in sputum; tests for IFN-γ; PCR test for **M.tuberculosis**	Multipleantimycobacterial drugs Prevention: pasteurizing milk; BCG vaccine
Melioidosis	**Burkholderia pseudomallei**	Pneumonia, or as tissue abscesses and severe sepsis	Moist soil	Bacterial culture	Ceftazidime

Diseases in Focus 24.3 (3 of 3)

Disease	Pathogen	Symptoms	Reservoir	Diagnosis	Treatment
Viral Diseases					
Respiratory Syncytial Virus (RSV) Disease	Respiratory syncytial virus	Pneumonia in infants	Humans	Serological tests	Palivizumab (if life-threatening)
Influenza	**Influenzavirus;** several serotypes	Chills, fever, headache, and muscular aches	Humans, pigs, birds	Serological EIA tests	Amantadine, oseltamivir phosphate (Tamiflu)
Fungal Diseases					
Histoplasmosis	**Histoplasma capsulatum**	Resembles tuberculosis	Soil; widespread in Ohio and Mississippi river valleys	Serological tests	Amphotericin B
Coccidioidomycosis	**Coccidioides immitis**	Fever, coughing, weight Loss	Desert soils of U.S. Southwest	Serological tests	Amphotericin B
Pneumocystis Pneumonia	**Pneumocystis jirovecii**	Pneumonia	Unknown; possibly humans or soil	Microscopy	Trimethoprimsulfamethoxazole, pentamidine
Blastomycosis	**Blastomyces dermatitidis**	Abscesses; extensive tissue damage	Soil in Mississippi Valley area	Isolation of pathogen	Amphotericin B